Regional HOT Lanes Network Feasibility Study

APPENDIX E

CORRIDOR ANALYSIS:
SR-237 FROM SR-85 TO I-880

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and

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Introduction

This memorandum applies a project development approach and set of corresponding design principles that were developed in Phase 3 Tasks 22.1 and 22.2 to the specific section of SR-237 from SR-85 to I-880. Similar memoranda were prepared for other selected corridors in the proposed MTC HOT lane network. These memoranda are intended both to advance the plans for HOT lane development in the corridors under study and to provide a basis for drawing conclusions about the likely impacts, costs, and design issues required to convert or develop HOT lanes in other network corridors not under detailed study.

At the direction of MTC and the Project Steering Committee, this analysis covered two approaches to developing HOT lanes in the corridor, the "Basic Approach"[1] and the "Revised Full Featured Approach"[2]. The primary difference between the two is that in constrained situations the Basic Approach allows for sub-standard inside shoulders and a reduction of lane widths from the 12-foot standard to 11 feet in order to make the added lane fit within the available right-of-way, while the Revised Full Featured Approach would maintain Caltrans design standards. Under exceptionally constrained conditions where freeway widening is infeasible due to cost or environmental reasons then the outside shoulder may also fall below Caltrans' 10-foot standard width for short distances.

This memorandum begins with a description of existing conditions in the corridor, followed by sections describing the proposed typical HOT lane sections and ingress and egress points, and closes with a section describing the study team's findings regarding development of HOT lanes in this corridor.

[1] This is derived from the "Rapid Delivery Approach" in Phase 2b of this study

[2] This is derived from the approach used in Phase 2 of this study, which assumed full Caltrans design standards

Existing Description of the Corridor

This corridor is approximately nine miles long, running from SR-85 to the I-880 interchange. This section of SR-237 is an urban freeway located in the cities of Mountain View, Sunnyvale, Santa Clara, and Milpitas (see Figure 1). There are four freeway interchanges (with SR-85 and US-101 in Mountain View, Lawrence Expressway in Sunnyvale, and I-880 in Milpitas) and nine other interchanges[3]. This section of SR-237 was until fairly recently a surface street but it was upgraded to a freeway with interstate standards in the 1990's. This makes it one of the newest portions of the proposed MTC HOT lane network. The right-of-way (ROW) allows for an ultimate 8-lane design (4 lanes per direction).

The section of SR-237 under study can be described as consisting of three design conditions from west-to-east:

- From SR-85 to the Mathilda Avenue Interchange, SR-237 has two general purpose lanes per direction.
- From the Mathilda Avenue Interchange to the Lawrence Expressway Interchange, SR-237 has two general purpose lanes plus an HOV lane per direction.
- From the Lawrence Expressway Interchange to I-880, SR-237 has two general purpose lanes plus an HOV lane per direction. There are auxiliary lanes between the Lawrence Expressway on ramp and the Great America off ramp, and from the Great America on ramp to the First Street off ramp.

The portion of SR-237 under study carries heavy volumes of commuter traffic during the AM and PM peak hours. The peak direction of travel is from the outside of the corridor (SR-85 and US-101 in the west and I-880 in the east) towards employment centers in the "Golden Triangle" employment area near the center of the corridor (Great American Parkway and 1st Street exits) in the morning and the reverse movements in the evening.

[3] From west to east these are at Dana Street/Whisman Rd/Moorpark Way, Middlefield Road, Mathilda Avenue, Fair Oaks Avenue, Lawrence Expressway, Great America Parkway, First Street, Zanker Road, McCarthy Boulevard

Daily traffic volumes vary from a low of 65,000 ADT at the Dana Street/Whisman Road Interchange and a high of 150,000 ADT at the McCarthy Boulevard Interchange. Although the corridor experiences heavy congestion on its general purpose lanes during the peak periods, traffic is light on the HOV lanes.

Other Projects and Studies in Vicinity

There are a number of projects that affect SR-237 in this area:

- HOV lanes are being added to I-880 both north and south of its interchange with SR-237. The lanes north of SR-237 were recently completed while the lanes south of SR-237 are under design. The HOV lanes on I-880 are expected to increase the use of the HOV lanes on SR-237.
- In December 2008 the Santa Clara Valley Transportation Authority (VTA) Board approved a project to consider converting the existing HOV connectors between I-880 and SR-237 (SB to WB and EB to NB) to HOT operation. This would alleviate the current situation where the general purpose connector experiences heavy congestion and queuing due to connector metering while the HOV connector is only lightly used. One study suggests that this could generate $38M over twenty-five years. The VTA Board has indicated that this is a high priority to them.
- A feasibility study was conducted to construct HOV direct connectors between US-101 and SR-237. The study concluded that they were not feasible due to high cost, possible interference with flight patterns at Moffett Air Field, potential environmental impacts on nearby reservoirs, and land use constraints.
- Caltrans has completed a PSR to construct auxiliary lanes on SR-237 from Zanker Road to First Street.
- A corridor study of the western portion of the corridor was completed in 2004 that gave a variety of recommendations, including a plan to extend the existing HOV lanes on SR-237 from their current termini near Mathilda Avenue through the interchange to SR-85. The estimated cost was $35M for 5.4 lane-miles, of which about $8M was for the replacement of the bridge across US-101. The remaining elements were expected to cost approximately $5.1M per lane-mile.

- Funds have been allocated to study modifications to the Mathilda Avenue Interchange, but this study has not yet started.
- There is a PSR underway that will cover:
    - o two ramps to be added to the Middlefield Interchange.
    - o a collector-distributor road to be added west of the Middlefield Interchange, and
    - o removal of the Dana Street ramps to improve traffic operations on SR-237.
- A second lane is to be added to the connector between northbound SR-85 and eastbound SR-237 to relieve congestion.

HOT Lanes Proposal – Mainline

The potential to provide the main line of the HOT facility varies by section along the freeway:

- For the section with existing HOV lanes (between Mathilda Avenue and I-880) conversion to a HOT lane can be accomplished by adding a 2-foot buffer between the HOV lane and the adjacent general purpose lanes, and providing appropriate signing and tolling equipment. This section has inside shoulders that are typically 5 feet and outside shoulders of 10-12 feet with additional space beyond the outside shoulder (see Figures 2 and 3).

  For the Basic Approach, the 2-foot buffer needed for conversion to a HOT lane can be created by reducing the inside HOV and adjacent general purpose lane from 12-feet to 11-feet, in accordance with the design trade-off guidance given in the Caltrans' *HOV Guidelines*[4]. An alternative solution would be to reduce the inside shoulder from 5 feet to 3 feet. Widening to the inside would have the advantage of not affecting the general purpose lanes.

  For the Revised Full-Featured Approach, the 2-foot buffer needed for conversion to a HOT lane can be created by strengthening the outside shoulder pavement,

[4] Source: Caltrans *High-Occupancy Vehicle Guidelines for Planning, Design, and Operations*, August 2003

shifting the general purpose lanes 2 feet towards the outside, and painting the buffer stripes in the space thus created between the HOV lane and the adjacent general purpose lane. However, where there are constraints outside the right shoulder, such as those in Figures 4 and 5, it would be more practical to reduce the inside shoulder by 2 feet.

For the section from Mathilda Avenue to US-101, where there are no existing HOV lanes, the inside shoulder is approximately 5 feet wide. Space for the HOT lanes could be created by widening to the outside within the existing ROW. There is a choke point at the bridge over US-101 which is too narrow to accommodate an additional lane (See Figure 6). Any modification of the bridge such as widening would trigger the need to bring it up to standard with respect to vertical clearance, which means that the entire bridge may need to be replaced.

- From US-101 to Maude Avenue, HOT lanes can be added by widening to the outside in the unused space within the ROW (see Figure 7).
- From Maude Avenue to SR-85, there is space to accommodate a HOT lane within the existing median. This would avoid the problem presented by the almost continuous presence of ramps (see Figure 8). The bridges over Maude Avenue and Central Expressway (see Figure 9) would need to be widened, but the bridge over Middlefield Road has enough space to accommodate an additional lane (see Figure 10).

HOT Lanes Proposal – Ingress and Egress Points

The approach taken in this study is that the placement of ingress and egress points should be primarily demand-driven; that is, ingress points should be located at a convenient distance downstream of places where large volumes of traffic enter the freeway system and egress points should be located at a convenient distance upstream of places where large volumes of traffic leave the freeway system. Once the high-demand locations were identified, a design analysis was then performed to determine whether an ingress or egress point could fit within the physical constraints of the location. In the event that the point could not be accommodated, a further analysis was performed to determine whether it could be accommodated by shifting the ingress or egress point to a nearby location. Alternate locations for ingress points were sought

downstream of the optimal point while alternate sites for egress points were sought upstream, meaning in effect that traffic wishing to enter or leave the HOT lane would have a longer distance in which to weave across the general purpose lanes. If no alternative site could be found, then consideration was given to dropping the proposed site with the assumption that potential users of the point would enter or exit the HOT lanes at other points in the corridor.

The assumed designs of the ingress and egress points are shown in Figures 11 and 12. These designs closely resemble the modified M-5 design for the access points proposed for the I-680 Sunol Express Lane in Alameda and Santa Clara Counties. Caltrans also has specified a required minimum distance between an HOV access point and the nearest freeway ramps (see Figure 13) that were considered when determining the location of potential ingress and egress areas.

Figures 14 through 17 show the volumes of traffic entering and exiting SR-237 at various points along the corridor[5]. The observable patterns are summarized below:

- The largest ramp volumes occur at the I-880 interchange, which is why HOV direct connectors in this location are a high priority for VTA.
- There are also high eastbound on-ramp and westbound off-ramp volumes at US-101 and SR-85.
- Besides the freeway interchanges, entering and exiting volumes are spread fairly evenly among the surface interchanges, except that the Dana Street ramps (near SR-85) carry lower volumes than the rest.

Based on the pattern of entering and exiting, a total of thirteen potential sites for ingress and egress points were identified for this corridor (see Figure 18). Table 1 describes the sites and the conclusions reached about each one. The comments column in Table 1 shows that four access points had to be moved from the original locations due to conflicts with ramps, and that eleven of the twelve access points that passed screening would be partially over or under a bridge.

[5] Source: Caltrans' *2007 Traffic Volumes Report*

The revised plan is summarized in Figure 19, and shown in detail in Figures 20 and 21.

Findings Regarding HOT Lane Development in this Corridor

It would be relatively easy to develop a HOT lane facility in this corridor since there is an existing HOV lane for roughly three-fourths of the corridor and because of the relatively generous space available in the median and outside the right shoulder. Closely-spaced ramps and a multitude of structures would complicate matters and increase costs, but not to a prohibitive extent. Moreover, the heavy peaking of commuter traffic in this corridor, coupled with the current under-use of the existing HOV lanes, would make this a good candidate for HOT lanes in terms of demand and connectivity to an adjacent committed HOT lane project at the connector.

Table 1: Summary of Potential Southbound Ingress and Egress Points

Site	Traffic Served	Conclusion	Comments on Feasibility
EB-I1	Entering from SR-85	Feasible	Tapers are on two bridges
EB-I2	Entering from US-101	Moved	The positions of these two were swapped to better meet the Caltrans' minimum required distances to nearby ramps. Both extend onto bridges.
EB-E1	Exiting to Lawrence Expressway	Moved	
EB-E2	Exiting to 1st Street & Great America	Feasible	Taper is on bridge
EB-E3	Exiting to Zanker Rd & SB I-880	Feasible	Space is available
EB-I3	Entering from 1st St. & Zanker Road	Feasible	Taper is on bridge
WB-E1	Exiting to 1st Street & Great America	Feasible	End of taper is under Zanker Road bridge
WB-I1	Entering from Zanker Rd	Feasible	May require retaining wall under 1st Street bridge
WB-E2	Exiting to Lawrence Expressway	Feasible	Tapers are on two bridges
WB-I2	Entering from 1st St. & Lawrence Expressway	Moved	The positions of these two were swapped to better meet the Caltrans' minimum required distances to nearby ramps. Both extend onto bridges.
WB-E3	Exiting to US-101	Moved	
WB-I3	Entering from US-101	Dropped	Not needed; too close to end of freeway
WB-E4	Exiting to SR-85	Feasible	Tapers are on two bridges

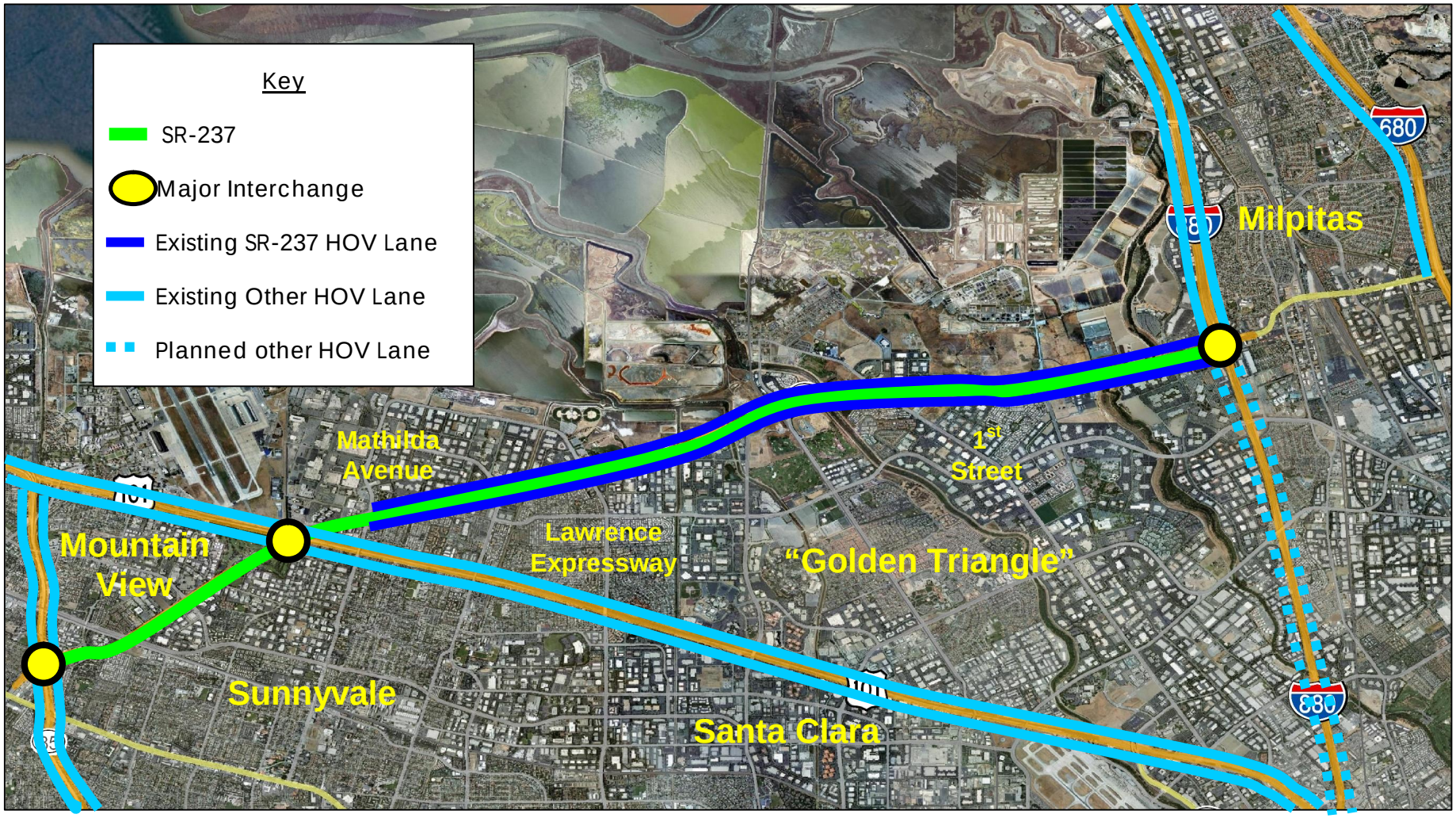

Figure 1: Study Corridor

Figure 2: North First Street Overcrossing

Figure 3: Section of SR-237 between Zanker Road and First Street looking Eastbound

Figure 4: Soundwall Eastbound Just East of Fair Oaks Avenue

Figure 5: Fair Oaks Avenue and LRT Overcrossing Looking Westbound
East Persian Drive (a frontage road) is on the right

Figure 6: The Bridge Crossing Over US-101

Figure 7: Section of SR-237 Through Sunnyvale Golf Course

Figure 8: Ramps Near Dana Street

Figure 9: SR-237 Bridge over Central Expressway

Figure 10: SR-237 Bridge over Middlefield Road. An additional lane can be accommodated in the median.

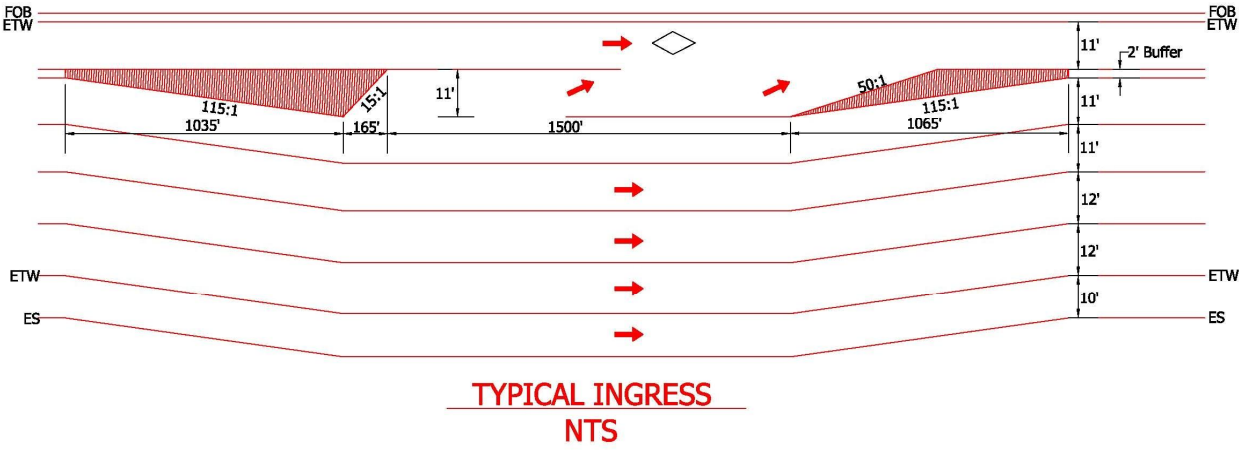

Figure 11: Typical Ingress Point for HOT Lane

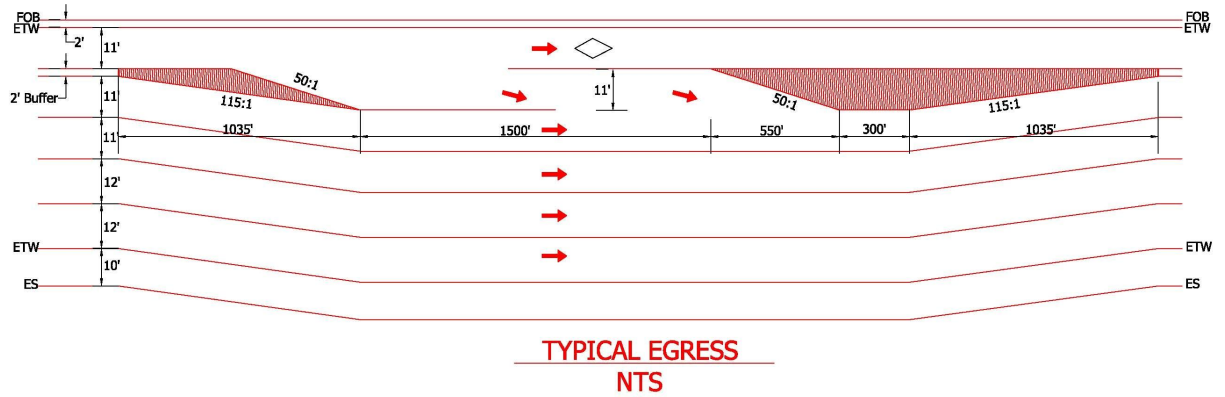

Figure 12: Typical Egress Point for HOT Lane

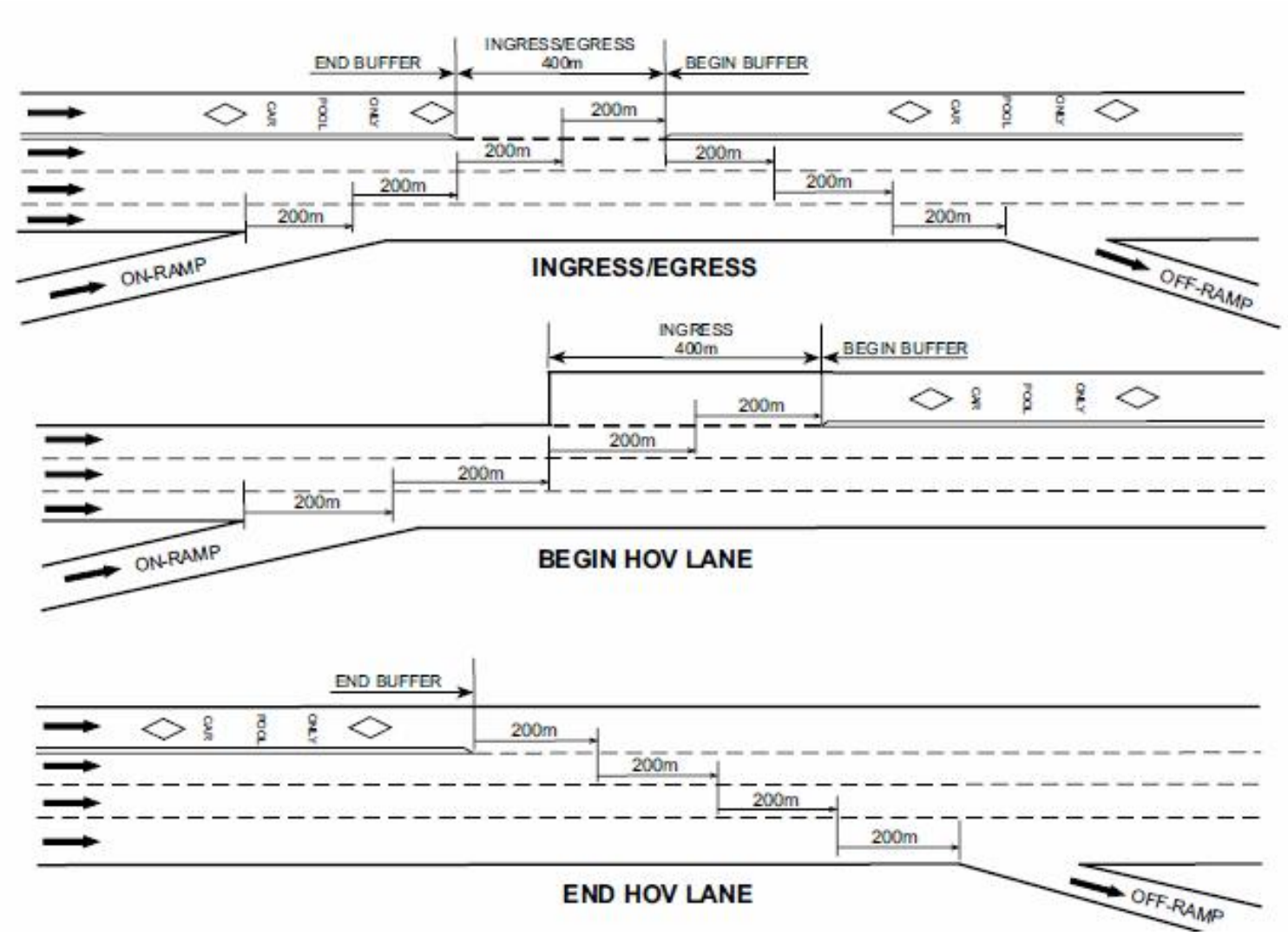

Figure 13: Caltrans Minimum Weave Distance at Buffer-Separated HOV Facilities

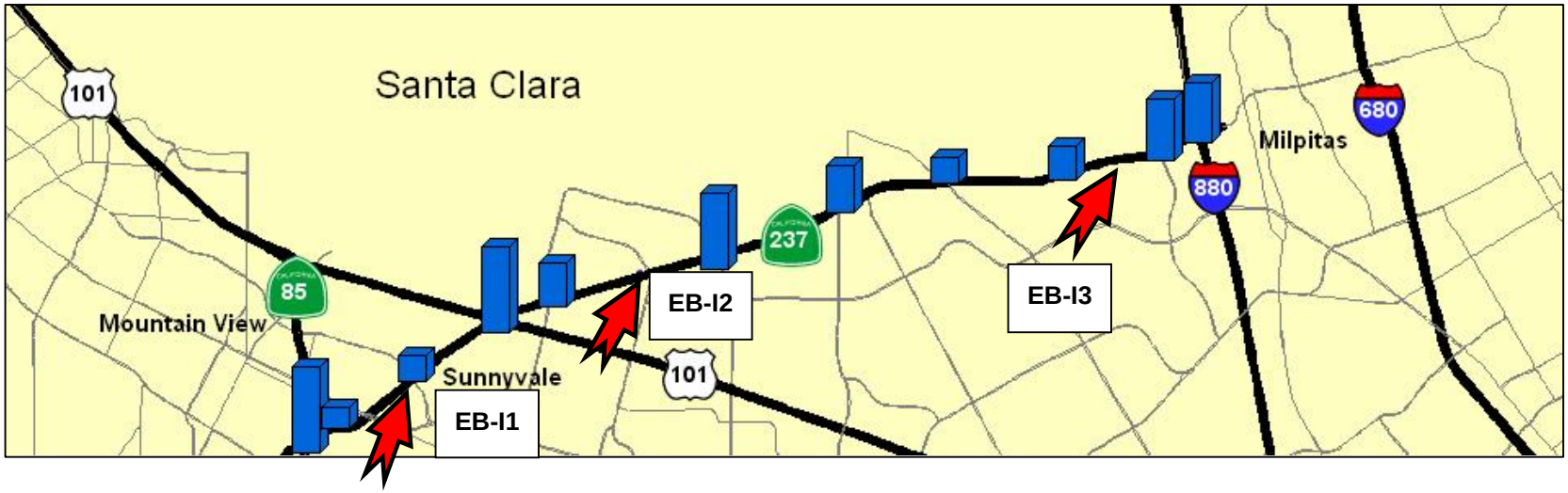

Figure 14: Eastbound On-Ramp Volumes and Potential Ingress Points

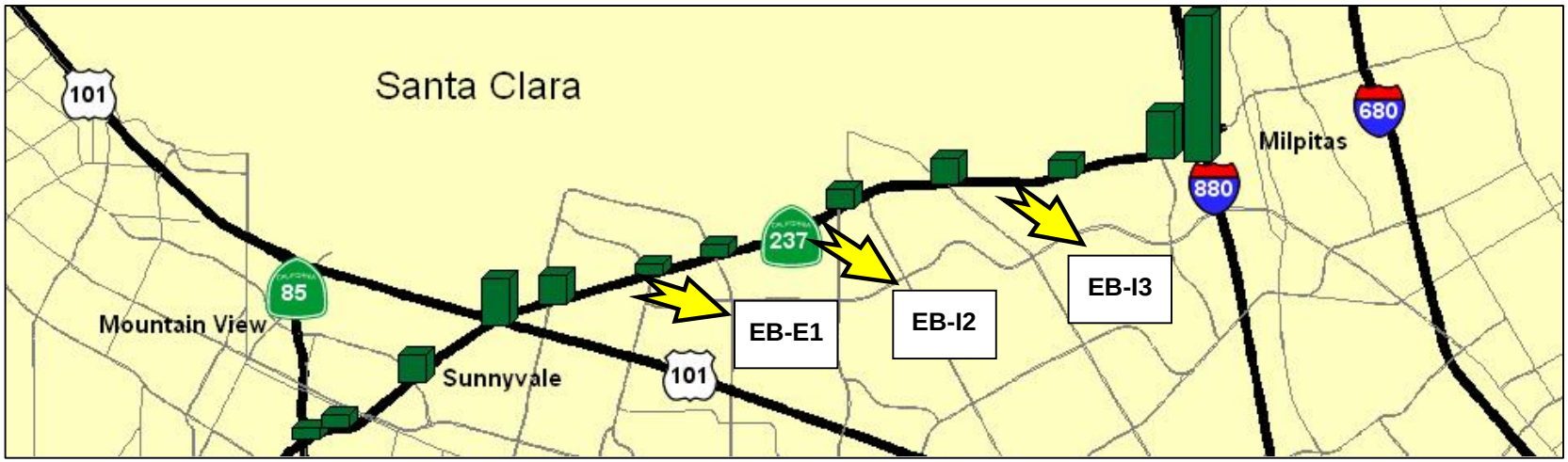

Figure 15: Eastbound Off-Ramp Volumes and Potential Egress Points

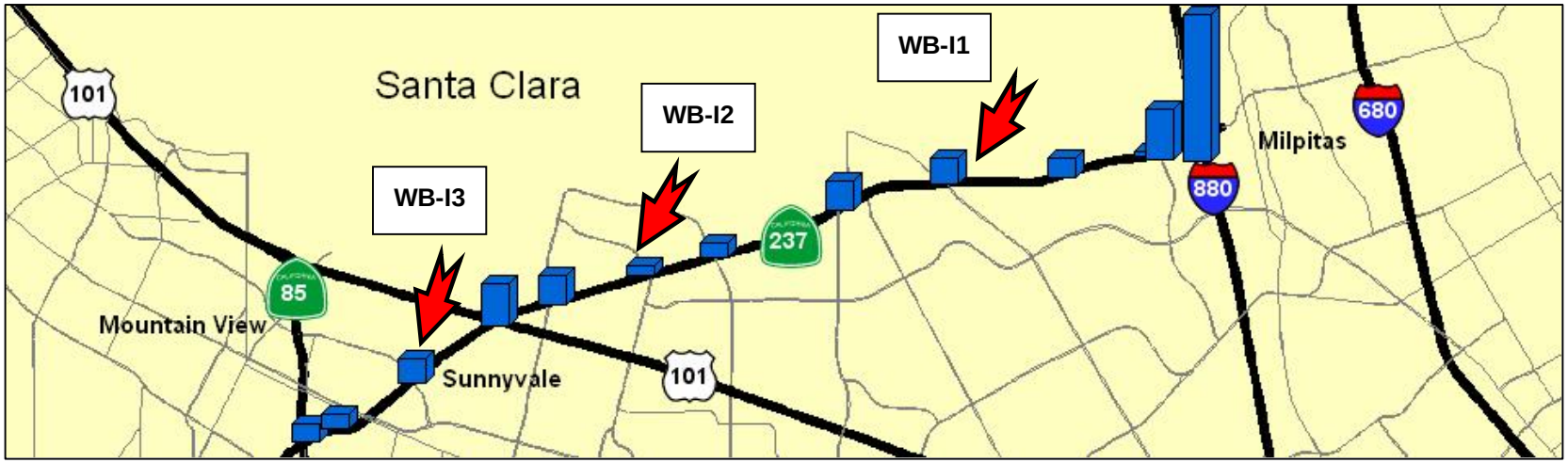

Figure 16: Westbound On-Ramp Volumes and Potential Ingress Points

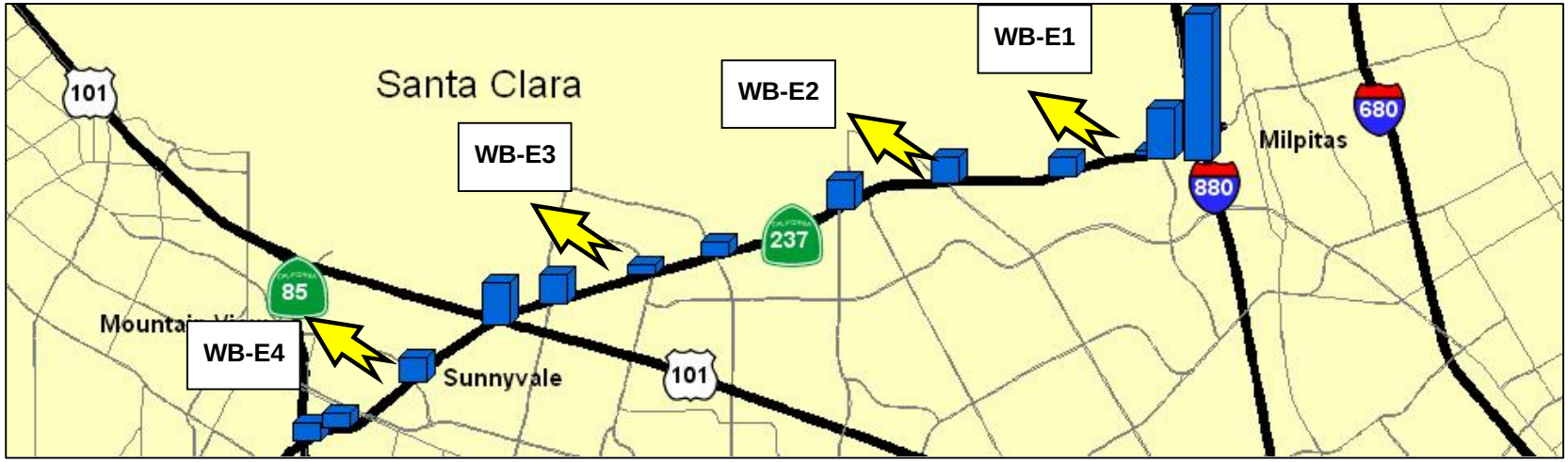

Figure 17: Westbound Off-Ramp Volumes and Potential Egress Points

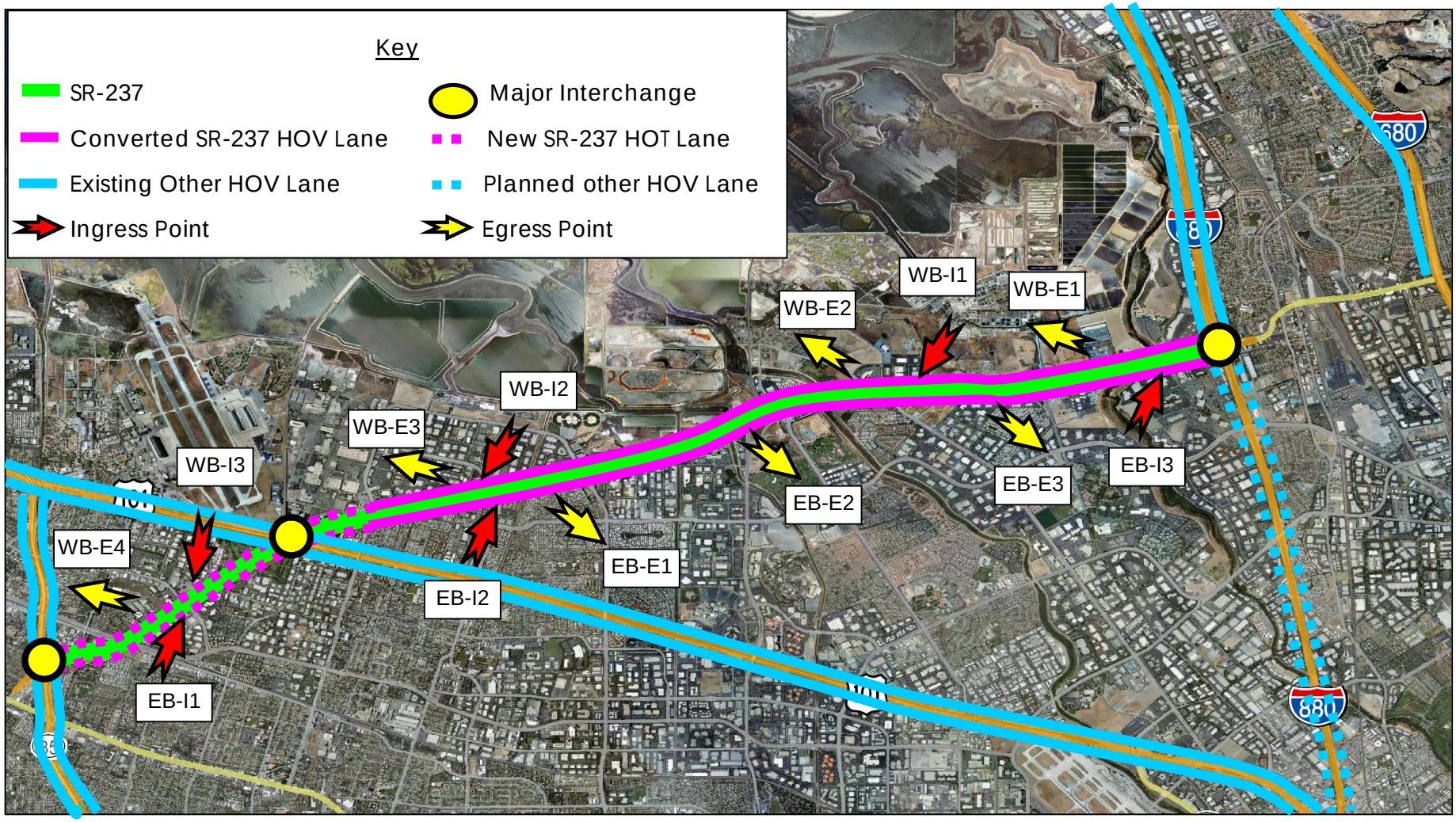

Figure 18: Sites Initially Identified for Potential Ingress and Egress Points

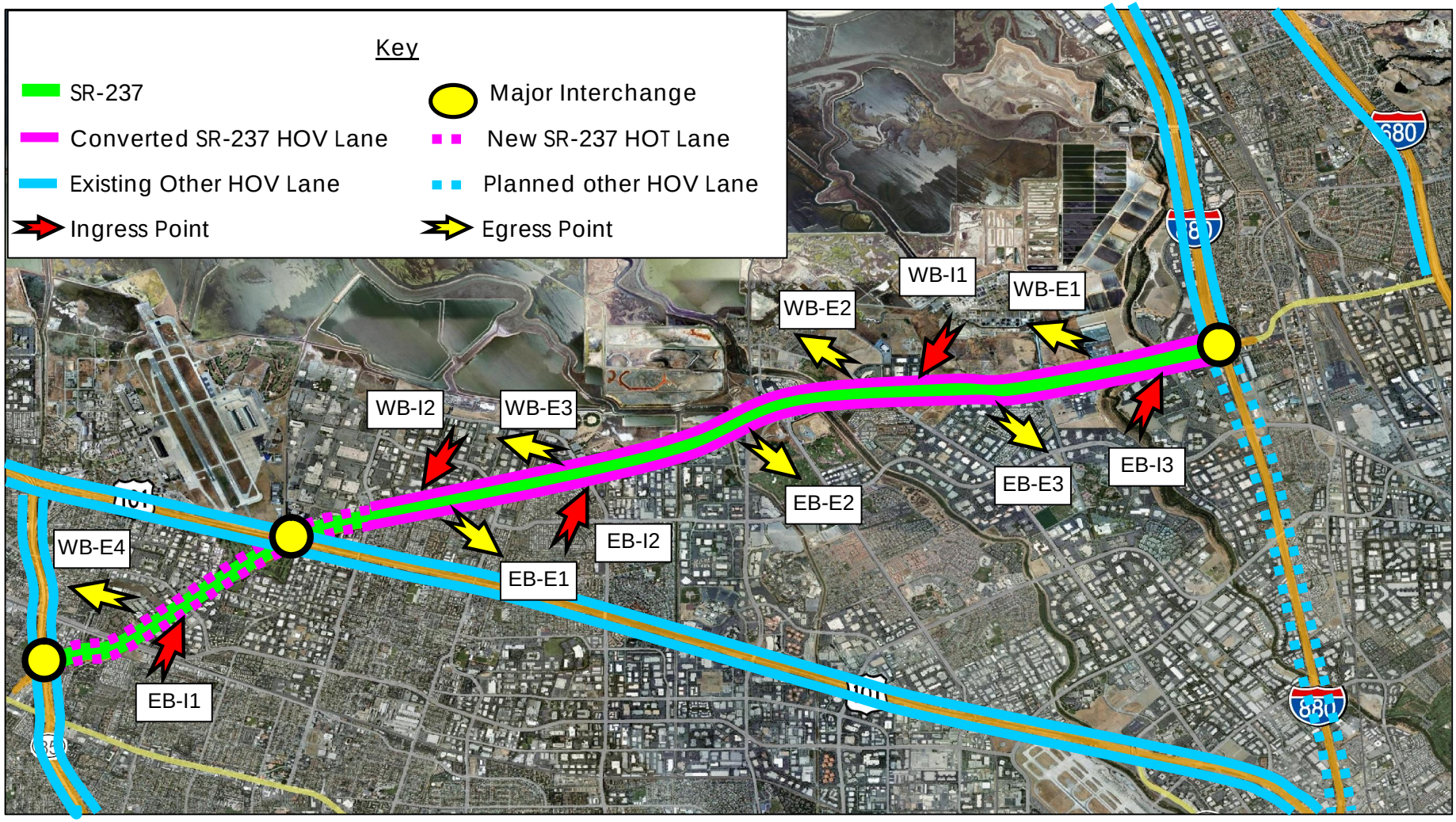

Figure 19: Sites Identified for Potential Ingress and Egress Points After Screening